Y/SUB/84-47974C/11

Y-12

OAK RIDGE Y-12 PLANT

MARTIN MARIETTA

L. L. McCauley says no restrictions on this report

PARTIAL CHARACTERIZATION OF SURFACE WATER AND SEDIMENT IN THE AREA RECEIVING RUNOFF FROM THE Y-12 OIL LANDFARM

June 1984

Document Prepared by
Bechtel National, Inc.
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37830
under
Purchase Order 86Y-47974C

for

Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-84OR21400

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Y/SUB/84-47974C/11

PARTIAL CHARACTERIZATION OF SURFACE WATER AND SEDIMENT IN THE AREA RECEIVING RUNOFF FROM THE Y-12 OIL LANDFARM

Document Completed - November 1983
Date of Issue - June 1984

*This document was written prior to April 1, 1984, by Bechtel National, Inc. under subcontract to Union Carbide Corporation, Nuclear Division for the U.S. Department of Energy under Contract W-7405-eng-26. The conclusions and recommendations expressed in this report are those of Bechtel National, Inc. and should not be interpreted as reflecting the views of Union Carbide Corporation Nuclear Division or Martin Marietta Energy Systems, Inc.

Document Prepared by
Bechtel National, Inc.
800 Oak Ridge Turnpike
Oak Ridge, Tennessee 37830
under
Purchase Order 86Y-47974C

for

Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-84OR21400

PARTIAL CHARACTERIZATION OF SURFACE WATER AND SEDIMENT IN THE AREA RECEIVING RUNOFF FROM THE Y-12 OIL LANDFARM

by

Bechtel National, Inc.
Oak Ridge, Tennessee
November 15, 1983

1.0 INTRODUCTION

The Y-12 Oil Landfarm, which began operation in 1972, was developed to microbially degrade waste oils. Environmental sampling conducted by Bechtel National, Inc., and Y-12 has indicated the presence of polychlorinated biphenyls (PCBs), uranium, and various chlorinated solvents within Oil Landfarm plots. (See Attachment 1, "Characterization and Remedial Action Plan for the Y-12 Oil Landfarm," submitted to Y-12 on October 28, 1983.) These materials may be transported offsite via surface water, ground water, and sediment.

A Memorandum of Understanding (MOU) between the U.S. Department of Energy, the U.S. Environmental Protection Agency (EPA), and the Tennessee Department of Health and Environment calls for a description of runoff from the Oil Landfarm (Paragraph VIII-1b). The following report was prepared to fulfill the terms of this agreement.

This report presents a description of the Oil Landfarm and receiving drainages. Also included are the results of a recently completed sampling program which was designed to characterize the potential contamination of surface water and sediment near the Oil Landfarm.

2.0 BACKGROUND AND HISTORICAL INFORMATION

A variety of methods has been utilized for disposal of waste oils, coolants, and mop waters generated at the Y-12 Plant since 1955. Prior to 1973, disposal practices included public sale of usable oils, open pit burning at the Y-12 Plant Burial Grounds, and pour-out trenches and standpipes in the Y-12 Plant Burial Grounds. During 1972, a method was developed for the Y-12 Plant which used natural soil microbial assimilatory processes to slowly degrade oily wastes. The process involved application of waste oils and coolants to nutrient adjusted soils followed by frequent soil cultivation to

maintain aerobic conditions. The area selected for the program is located north of the Y-12 Centralized Sanitary Landfill I in Bear Creek Valley and has been designated as the Y-12 Plant Oil Landfarm.

Initially, the facility consisted of 1.3 acres of land (six plots excluding roadways) prepared for application of waste oils and coolants. The facility size gradually increased to 4.0 acres (24 plots excluding roadways) in 1979 to accommodate increased waste oil and coolant generation rates.

Beginning in May, 1973, wastes were collected in tank trucks, distributed over the surface of the plots, and cultivated into the top three inches of soil. The plots were cultivated frequently between application periods. The application dates were selected to minimize impacts of precedent rainfall and forecasted antecedent rainfall events. The Oil Landfarm was operated on a seasonal basis from April to October to permit favorable conditions for soil microbial activity.

Since 1973, approximately one million gallons of wastes have been applied to the plots at the Oil Landfarm. Wastes placed on the Oil Landfarm included ("Characterization and Remedial Action Plan for the Y-12 Plant Oil Landfarm," October 28, 1983):

- waste oils (containing PCBs and various chlorinated solvents), 1,222,410 lb;
- oils (containing PCBs) which were skimmed from the Oil Retention Ponds in Y-12 Burial Ground A, 15,000 gallons;
- beryllium-contaminated oils, 500,738 lb;
- coolants, 3,361,858 lb;
- mop waters, 163,885 lb;
- tanker oils from the Oak Ridge Gaseous Diffusion Plant (ORGDP), 844,203 lb;
- wastes from cooling tower, basin and burial grounds, 239,000 lb;
- unidentified miscellaneous liquid wastes, 1,186,813 lb.

All waste applications at the Oil Landfarm were discontinued in October, 1982.

3.0 DESCRIPTION OF THE OIL LANDFARM AND ITS WATERSHED

Currently, the Oil Landfarm consists of 24 plots. Each area between roadways actually consists of two east-west oriented plots (see Figure 1). The plots can be grouped in three locales: the south and eastern plots (1-12), the south and western plots (13-18), and the northern plots (19-24). The three locales have surface areas (including roadways) of 3.5 acres for plots 1-12, 1.6 acres for plots 13-18, and 1.9 acres for plots 19-24.

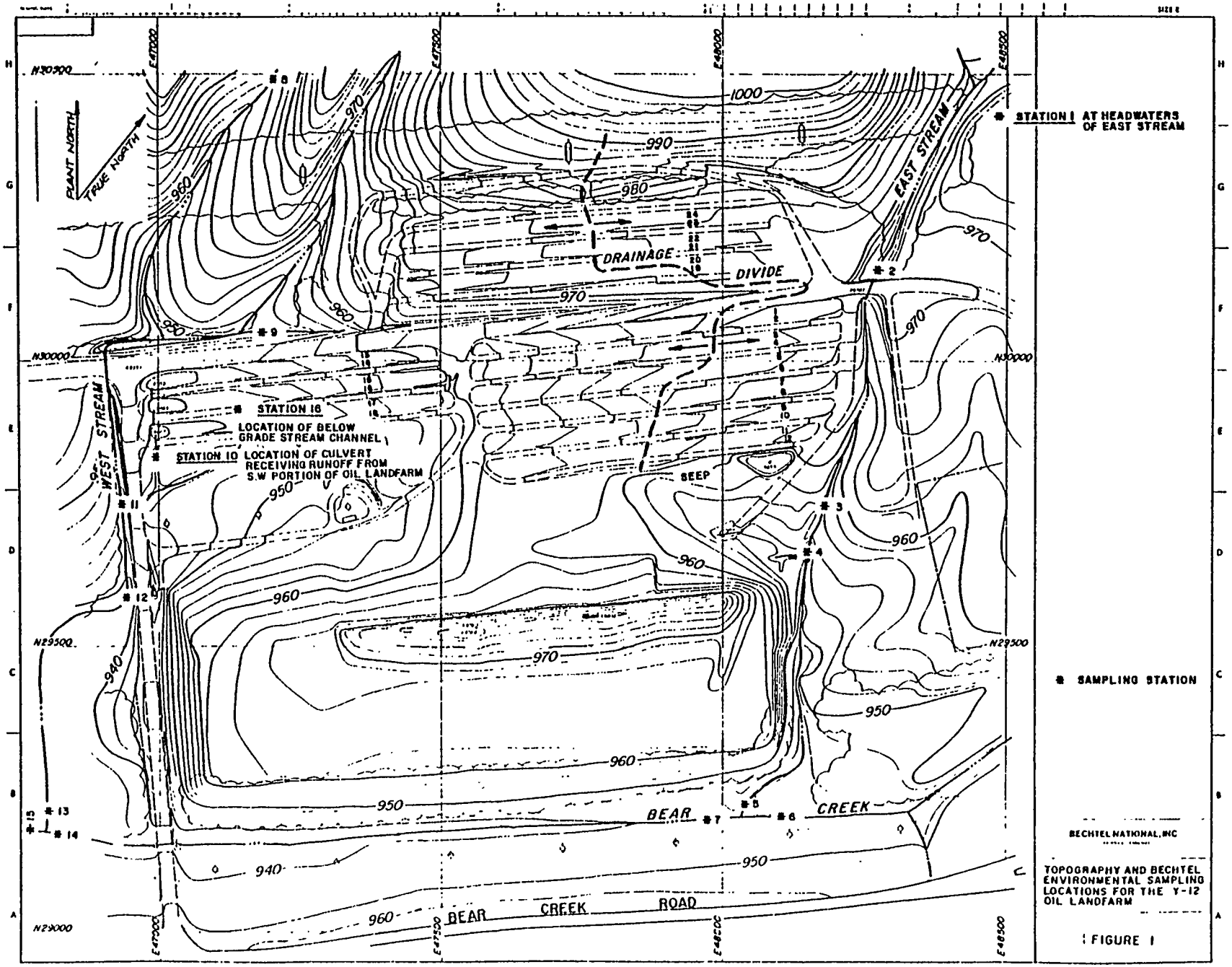
Two intermittent streams receive runoff from the Oil Landfarm before discharging into Bear Creek. The locations of these streams (designated the West Stream and the East Stream) are illustrated in Figure 1. The West Stream receives runoff from a total surface area of 76 acres while the East Stream drains an area of 73 acres. Using the contours indicated in Figure 1, a drainage divide was drawn for the Oil Landfarm. This divide indicates that the bulk (approximately 70%) of the Landfarm surface area drains in the direction of the West Stream.

Other prominent hydrologic features of the Landfarm include:

1) A culvert located at the southwest portion of plots 13-18 which acts as a point discharge for Landfarm surface runoff into a small tributary of the West Stream.
2) A below grade, stream channel which flows south across the western portion of plots 1-12. This channel discharges into a tributary of the West Stream and is open to the surface on a roadway between plots via a steel grate.
3) A seep which originates along the southern portion of plots 1-12 and discharges into the East Stream.

4.0 CHEMICAL CHARACTERIZATION OF THE OIL LANDFARM DRAINAGE BASIN

In response to the MOU, a sampling program was implemented to characterize the Oil Landfarm for remedial action planning. Prior to the implementation of this plan, no data describing the chemical characteristics of site surface waters and sediment were available.


PLANT NORTH
TRUE NORTH
STATION 1 AT HEADWATERS OF EAST STREAM
EAST STREAM
DRAINAGE DIVIDE
WEST STREAM
STATION 16
LOCATION OF BELOW GRADE STREAM CHANNEL
STATION 10 LOCATION OF CULVERT RECEIVING RUNOFF FROM S.W PORTION OF OIL LANDFARM
SEEP
BEAR CREEK
BEAR CREEK ROAD
N30500
N30000
N29500
N29000
E47500
E48000
E48500
1000
990
980
970
960
950
940
SAMPLING STATION
BECHTEL NATIONAL, INC
TOPOGRAPHY AND BECHTEL ENVIRONMENTAL SAMPLING LOCATIONS FOR THE Y-12 OIL LANDFARM
FIGURE 1

Sampling station locations (see Figure 1) were chosen to provide information describing the potential transport of contaminants from the Oil Landfarm. Stations which were selected to be representative of background conditions (Stations 1 and 8) for the West and East Streams were located upgradient of Oil Landfarm operations. Stations were also located in Bear Creek upstream (Stations 14 and 6) and downstream (Stations 15 and 7) of the confluences of the West and East Streams to determine the extent of offsite contaminant migration.

To be consistent with National Pollutant Discharge Elimination System permitting requirements (40 CFR 122), water samples were analyzed for:

- Biochemical Oxygen Demand ($BOD_{5\ Day}$)
- Chemical Oxygen Demand
- Total Organic Carbon
- Total Suspended Solids
- Ammonia (as N)
- Temperature
- pH
- Volatile Organics
- Acid/Base Neutral Extractable Compounds (on selected samples)
- PCBs
- Metals, Cyanides, and Phenols
- Other Conventional and Nonconventional Pollutants.

Sediment samples were analyzed for:

- Volatile Organics
- Acid/Base Neutral Extractable Compounds (on selected samples)
- PCBs
- Metals, Cyanides, and Phenols
- Other Conventional and Nonconventional Pollutants.

Suspended solids were collected and analyzed to determine if this medium was a significant transport mechanism for PCBs. Filtered and unfiltered water were also analyzed to determine if metals were being transported as suspended solids.

All water and sediment was collected by grab sampling. Water from the below grade stream channel was collected using a peristaltic pump. Samples were collected using a low pumping rate (<0.5 liter/minute) to avoid potential loss of volatile organics. Water was pumped through Teflon tubing to reduce the possibility of contaminant leaching from or adsorption on tubing walls. Sample collection using the peristaltic pump was done in accordance with EPA recommended methods (Ford et al. 1983).

Analytical results are presented in the following tables:

1) Volatile Organics in Water, Table 1
2) Volatile Organics in Sediment, Table 2
3) Base Neutral Extractable Organics in Water, Table 3
4) Base Neutral Extractable Organics in Sediment, Table 4
5) Acid Extractable Organics in Water, Table 5
6) Acid Extractable Organics in Sediment, Table 6
7) PCBs, Table 7
8) Total Metals, Cyanide, and Phenols in Water, Table 8
9) Dissolved Metals in Water, Table 9
10) Metals, Cyanide, and Phenols in Sediment, Table 10
11) Miscellaneous Parameters, Table 11

Review of results obtained from the recently implemented sampling program indicate:

Volatile Organic Priority Pollutants

- Toluene was the only volatile organic detected in background samples (Stations 1 and 8).
- Volatile organics were detected in water at Station 16 (the below grade stream channel). This may indicate upgradient contamination or contaminant influx

directly from Landfarm plots. Volatile organic concentrations were close to the limit of detection at all other sampling locations.

- The West Stream has greater concentrations of volatile organics than the East Stream. This may be a result of a greater Landfarm area draining into the West Stream than into the East Stream or upgradient contamination entering this stream via the below grade stream channel.

Acid/Base Neutral Extractable Organics

- No Acid/Base Neutral Extractable Organics were detected in water.
- Acid/Base Neutral Extractable Organics were only detected in sediment at Station 3.

PCBs

- PCBs in water were less than 0.3 ppb for all aroclors at all stations sampled.
- PCBs do not appear to be migrating from Landfarm plots as suspended solids.
- Station 10, which receives direct runoff from the western portion of the Oil Landfarm, had the highest observed PCB concentration (1.1 ppm - Aroclor 1260). This concentration, however, is below the EPA recommended action level of 50 ppm.

Metals, Cyanide, and Phenol

- Elevated concentrations (relative to background - Station 1) of total boron and uranium were present in the East Stream.
- Total mercury in water was below the detection limit at all stations for which analytical results have been completed (Stations 1, 8, 9, 10, and 16).

- Uranium was detected in sediments of the East Stream at locations south of the Oil Landfarm (Stations 3, 4, and 5). The maximum observed concentration for uranium in sediment was 635 ppm at Station 3. Uranium in sediments was also observed upstream and downstream of the confluence of the East Stream with Bear Creek.
- Elevated concentrations (relative to background - Station 8) of boron were observed in sediment in the West Stream, and downstream of its confluence with Bear Creek.
- Elevated (relative to background) concentrations of titanium were found in the sediment of the East Stream (Stations 2, 3, and 4) and downstream of this stream's confluence with Bear Creek (Station 7). Titanium was also elevated in the sediment of the West Stream (Stations 9, 10, 11, and 12) and upstream and downstream of this stream's confluence with Bear Creek.
- Elevated (relative to background) concentrations of beryllium were found in the sediment of the West Stream (Stations 11 and 12). The highest observed concentration for beryllium in sediment (7.3 ppm) at the Landfarm was found at Station 10 which receives runoff directly from the southwest portion of the Oil Landfarm.
- Elevated concentrations of mercury were observed in sediment in the East Stream. The highest observed concentration was 60 ppm at a point just south of the Oil Landfarm (Station 3). Concentrations of mercury in sediment decreased gradually from this location to the stream's confluence with Bear Creek. Mercury in sediment was below detectable concentration upstream and downstream of this confluence with Bear Creek.

Miscellaneous Parameters

- High Chemical Oxygen Demand relative to Biochemical Oxygen Demand was observed at stations receiving drainage from the western portion of the Oil Landfarm (Stations 10, 11, and 12). This indicates that organics in runoff from this are not readily degraded by standard seed organisms.
- Elevated concentrations of nitrate were found in Bear Creek upstream and downstream of the confluences of the West and East Streams with Bear Creek. Nitrate concentrations were not elevated in the West and East Streams indicating that the Oil Landfarm is not the major source of this compound in Bear Creek.
- Fluoride concentrations were elevated (relative to background) at Stations 5, 7, and 16.
- Elevated concentrations (relative to background) of organic nitrogen (total Kjeldahl nitrogen minus ammonia) in water, oil, and grease in sediment were found at Station 10.

REFERENCES

Attachment: Characterization and Remedial Action Plan for the Y-12 Plant Oil Landfarm, October 28, 1983.

Ford, J., P. J. Turing, D. E. Seely. Characterization of Hazardous Waste Sites - A Methods Manual, Volume 2, Available Sampling Methods. Report Prepared by GCA Corporation for Lockheed Engineering and Management Services Co., Inc., Under EPA Contract 68-03-3050, September 1983.

SAMPLING DATES AND LOCATIONS OF STATIONS IN THE OIL LANDFARM

STATION 1: 10/24/83
NEAR THE HEADWATERS OF EAST STREAM

STATION 2: 10/14/83
EAST STREAM, NORTHEAST OF PLOTS 1-2

STATION 3: 10/24/83
EAST STREAM, SOUTHEAST OF PLOTS 11-12

STATION 4: 10/24/83
EAST STREAM, EAST OF SANITARY LANDFILL AND NORTH OF DISCHARGE INTO BEAR CREEK

STATION 5: 10/24/83
EAST STREAM, BEFORE DISCHARGE INTO BEAR CREEK

STATION 6: 10/24/83
BEAR CREEK, UPSTREAM OF EAST STREAM DISCHARGE INTO BEAR CREEK

STATION 7: 10/24/83
BEAR CREEK, DOWNSTREAM OF EAST STREAM DISCHARGE INTO BEAR CREEK

STATION 8: 10/14/83
NEAR THE HEADWATERS OF WEST STREAM

STATION 9: 10/14/83
DRAINAGE DITCH NORTH OF PLOTS 13-18

STATION 10: 10/14/83
CULVERT DRAINING WESTERN PORTIONS OF PLOTS 13-18

STATION 11: 9/22/83
DISCHARGE OF CULVERT DRAINING AREA SOUTH OF PLOTS 13-18

STATION 12: 9/22/83
DISCHARGE OF CULVERT DRAINING AREA SOUTH OF PLOTS 13-18 AND POSSIBLY FROM SANITARY LANDFILL

STATION 13: 10/26/83
WEST STREAM BEFORE DISCHARGE INTO BEAR CREEK

STATION 14: 9/22/83
BEAR CREEK, UPSTREAM OF WEST STREAM DISCHARGE INTO BEAR CREEK

STATION 15: 9/22/83
BEAR CREEK, DOWNSTREAM OF WEST STREAM DISCHARGE INTO BEAR CREEK

STATION 16: 10/10/83
SUBMERGED STREAM UNDER WESTERN PORTION OF OIL LANDFARM

NOTES FOR TABLES 1-11

N = NOT DETECTED

< INDICATES THAT A PARAMETER WAS DETECTED BUT AT A CONCENTRATION LESS THAN THE INDICATED VALUE

CACO3 = CALCIUM CARBONATE

UMHOS = MICROMHOS

MV = MILLIVOLTS

PH = pH

BLANK SPACE INDICATES THAT THE ANALYSIS HAS NOT BEEN COMPLETED OR THAT SAMPLES WERE NOT COLLECTED FOR ANALYSIS OF THIS PARAMETER

NOTES FOR SOIL TABLES DATED 1/24/84:

1). N = NOT DETECTED

2). < INDICATES THAT A PARAMETER WAS DETECTED BUT AT A CONCENTRATION LESS THAN THE INDICATED VALUE

3). * INDICATES THAT THE ANALYSIS HAS NOT BEEN COMPLETED OR THAT SAMPLES WERE NOT COLLECTED FOR ANALYSIS OF THIS PARAMETER

NOTES ON TABLES FOR OIL LANDFARM (1/13/83)

N = NOT DETECTED

< INDICATES THAT A PARAMETER WAS DETECTED BUT AT A CONCENTRATION LESS THAN THE INDICATED VALUE

CACO3 = CALCIUM CARBONATE

UMHOS = MICROMHOS

MV = MILLIVOLTS

PH = pH

* INDICATES THAT THE ANALYSIS HAS NOT BEEN COMPLETED OR THAT SAMPLES WERE NOT COLLECTED FOR ANALYSIS OF THIS PARAMETER

TABLE 1

VOLATILE ORGANIC PRIORITY POLLUTANTS IN WATER
UNIT=PPB

FACILITY: OIL LANDFARM

VOLATILE ORGANIC / STATION	1	5	6	7	8	9	10	11	12	14	15	16
ACROLEIN	N	N	N	N	N	N	N	N	N	N	N	N
ACRYLONITRILE	N	N	N	N	N	N	N	N	N	N	N	N
BENZENE	N	N	N	N	N	N	N	N	N	N	N	N
BROMOFORM	N	N	N	N	N	N	N	N	N	N	N	N
CARBON TETRACHLORIDE	N	N	N	N	N	N	N	N	N	N	N	N
CHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N	N
CHLORODIBROMOMETHANE	N	N	N	N	N	N	N	N	N	N	N	N
CHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N
2-CHLOROETHYL VINYL ETHER	N	N	N	N	N	N	N	N	N	N	N	N
CHLOROFORM	N	N	N	N	N	N	N	N	N	N	N	N
DICHLOROBROMOMETHANE	N	N	N	N	N	N	N	N	N	N	N	N
DICHLORODIFLUOROMETHANE	N	N	N	N	N	N	N	N	N	N	N	N
1,1-DICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	<10
1,2-DICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N
1,1-DICHLOROETHYLENE	N	N	N	N	N	N	N	N	N	N	N	<10
1,2-DICHLOROPROPANE	N	N	N	N	N	N	N	N	N	N	N	N
CIS-1,3-DICHLOROPROPYLENE	N	N	N	N	N	N	N	N	N	N	N	N
TRANS-1,3-DICHLOROPROPYLENE	N	N	N	N	N	N	N	N	N	N	N	N
ETHYL BENZENE	N	N	N	N	N	N	N	N	N	N	N	N
METHYL BROMIDE	N	N	N	N	N	N	N	N	N	N	N	N
METHYL CHLORIDE	N	N	N	N	N	N	N	N	N	N	N	N
METHYLENE CHLORIDE	N	N	N	N	N	N	<10	N	N	N	N	<10
1,1,2,2-TETRACHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N
TETRACHLOROETHYLENE	N	N	N	N	N	N	N	N	<10	N	N	15
TOLUENE	<10	N	N	N	N	N	N	N	N	N	N	N
TRANS-1,2-DICHLOROETHYLENE	N	N	N	N	N	N	N	N	N	N	N	57
1,1,1-TRICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	<10
1,1,2-TRICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N
TRICHLOROETHYLENE	N	N	N	N	N	N	N	N	N	N	N	12
TRICHLOROFLUOROMETHANE	N	N	N	N	N	N	N	N	N	N	N	N
VINYL CHLORIDE	N	N	N	N	N	N	N	N	N	N	N	16
METHYL ETHYL KETONE	N	N	N	N	N	N	N	N	N	N	N	N
TETRAHYDROFURAN				N								

TABLE 2

VOLATILE ORGANIC PRIORITY POLLUTANTS IN SEDIMENT
UNIT=PPB

FACILITY: OIL LANDFARM

)LATILE STATION IGANIC	1	2	3	4	6	7	8	9	10	11	12	13	14	15
:ROLEIN	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:RYLONITRILE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:NZENE	N	N	N	N	N	N	N	N	N	<10	<10	N	<10	<10
:OM:FORM	N	N	N	N	N	N	N	N	N	N	N	N	N	N
\RBON TETRACHLORIDE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:LOROBENZENE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:LORODIBROMOMETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:LOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
-CHLOROETHYL VINYL ETHER	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:LOROFORM	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:CHLOROBROMOMETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:CHLORODIFLUOROMETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
,1-DICHLOROETHANE	N	N	18	N	N	N	N	N	N	N	N	N	N	N
,2-DICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
,1-DICHLOROETHYLENE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
2-DICHLOROPROPANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
'S-1,3-DICHLOROPROPYLENE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:ANS-1,3-DICHLOROPROPYLENE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:HYL BENZENE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:THYL BROMIDE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:THYL CHLORIDE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:THYLENE CHLORIDE	<10	N	N	N	N	N	N	N	N	48	26	<10	76	68
1,2,2-TETRACHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:TRACHLOROETHYLENE	N	N	<10	N	N	N	N	N	<10	<10	150	N	N	N
)LUENE	<10	N	<10	N	N	N	N	<10	N	N	N	N	N	N
:ANS-1,2-DICHLOROETHYLENE	N	N	<10	N	N	N	N	N	N	N	N	N	N	N
1,1-TRICHLOROETHANE	N	N	<10	N	N	N	N	N	N	N	N	N	N	N
1,2-TRICHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:ICHLOROETHYLENE	N	N	<10	N	N	N	N	N	N	N	<10	N	<10	<10
:ICHLOROFLUOROMETHANE	N	N	N	N	N	N	N	N	N	<10	<10	N	<10	<10
NYL CHLORIDE	N	N	N	N	N	N	N	N	N	N	N	N	N	N
:THYL ETHYL KETONE	N	N	N	N	17	N	N	N	19	<10	<10	N	N	N
:TRAHYDROFURAN			N	N	N	N						<10		

TABLE 3

BASE-NEUTRAL EXTRACTABLE ORGANIC PRIORITY POLLUTANTS IN WATER
UNIT=PPB

FACILITY: OIL LANDFARM

BASE-NEUTRAL EXTRACTABLE ORGANIC	STATION 1	5	6	7	8	9	10	16
ACENAPHTHENE	N	N	N	N	N	N	N	N
ACENAPHTHYLENE	N	N	N	N	N	N	N	N
ANTHRACENE	N	N	N	N	N	N	N	N
BENZIDINE	N	N	N	N	N	N	N	N
BENZO(A)ANTHRACENE	N	N	N	N	N	N	N	N
BENZO(A)PYRENE	N	N	N	N	N	N	N	N
3,4-BENZOFLUORANTHENE*	N	N	N	N	N	N	N	N
BENZO(GHI)PERYLENE	N	N	N	N	N	N	N	N
BIS(2-CHLOROETHOXY)METHANE	N	N	N	N	N	N	N	N
BIS(2-CHLOROETHYL)ETHER	N	N	N	N	N	N	N	N
BIS(2-CHLOROISOPROPYL)ETHER	N	N	N	N	N	N	N	N
BIS(2-ETHYLHEXYL)PHTHALATE	N	N	N	N	N	N	N	N
4-BROMOPHENYL PHENYL ETHER	N	N	N	N	N	N	N	N
BUTYL BENZYLPHTHALATE	N	N	N	N	N	N	N	N
2-CHLORONAPHTHALENE	N	N	N	N	N	N	N	N
4-CHLORO-PHENYL PHENYL ETHER	N	N	N	N	N	N	N	N
CHRYSENE	N	N	N	N	N	N	N	N
DIBENZO(A,H)ANTHRACENE	N	N	N	N	N	N	N	N
1,2-DICHLOROBENZENE	N	N	N	N	N	N	N	N
1,3-DICHLOROBENZENE	N	N	N	N	N	N	N	N
1,4-DICHLOROBENZENE	N	N	N	N	N	N	N	N
3,3'-DICHLOROBENZIDINE	N	N	N	N	N	N	N	N
DIETHYLPHTHALATE	N	N	N	N	N	N	N	N
DIMETHYLPHTHALATE	N	N	N	N	N	N	N	N
DI-N-BUTYLPHTHALATE	N	N	N	N	N	N	N	N
2,4-DINITROTOLUENE	N	N	N	N	N	N	N	N
2,6-DINITROTOLUENE	N	N	N	N	N	N	N	N
DI-N-OCTYLPHTHALATE	N	N	N	N	N	N	N	N
1,2-DIPHENYLHYDRAZINE**	N	N	N	N	N	N	N	N
FLUORANTHENE	N	N	N	N	N	N	N	N
FLUORENE	N	N	N	N	N	N	N	N
HEXACHLOROBENZENE	N	N	N	N	N	N	N	N
HEXACHLOROBUTADIENE	N	N	N	N	N	N	N	N
HEXACHLOROCYCLOPENTADIENE	N	N	N	N	N	N	N	N
HEXACHLOROETHANE	N	N	N	N	N	N	N	N
IDENO(1,2,3-CD)PYRENE	N	N	N	N	N	N	N	N
ISOPHORONE	N	N	N	N	N	N	N	N
NAPHTHALENE	N	N	N	N	N	N	N	N
NITROBENZENE	N	N	N	N	N	N	N	N
N-NITROSODIMETHYLAMINE	N	N	N	N	N	N	N	N
N-NITROSODI-N-PROPYLAMINE	N	N	N	N	N	N	N	N
N-NITROSODIPHENYLAMINE***	N	N	N	N	N	N	N	N
PHENANTHRENE	N	N	N	N	N	N	N	N
PYRENE	N	N	N	N	N	N	N	N
1,2,4-TRICHLOROBENZENE	N	N	N	N	N	N	N	N
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	N	N	N	N	N	N	N	N

* AND/OR BENZO(K)FLUORANTHENE - ISOMERIC PAIRS
** DETECTED AS AZOBENZENE
*** DETECTED AS DIPHENYLAMINE

TABLE 4

BASE-NEUTRAL EXTRACTABLE ORGANIC PRIORITY POLLUTANTS IN SEDIMENT
UNIT=PPM

FACILITY: OIL LANDFARM

BASE-NEUTRAL EXTRACTABLE ORGANIC	STATION 1	2	3	4	5	6	7	8	9	10	13
ACENAPHTHENE	N	N	N	N	N	N	N	N	N	N	N
ACENAPHTHYLENE	N	N	N	N	N	N	N	N	N	N	N
ANTHRACENE	N	N	N	N	N	N	N	N	N	N	N
BENZIDINE	N	N	N	N	N	N	N	N	N	N	N
BENZO(A)ANTHRACENE	N	N	3	N	N	N	N	N	N	N	N
BENZO(A)PYRENE	N	N	N	N	N	N	N	N	N	N	N
3,4-BENZOFLUORANTHENE*	N	N	3	N	N	N	N	N	N	N	N
BENZO(GHI)PERYLENE	N	N	N	N	N	N	N	N	N	N	N
BIS(2-CHLOROETHOXY)METHANE	N	N	N	N	N	N	N	N	N	N	N
BIS(2-CHLOROETHYL)ETHER	N	N	N	N	N	N	N	N	N	N	N
BIS(2-CHLOROISOPROPYL)ETHER	N	N	N	N	N	N	N	N	N	N	N
BIS(2-ETHYLHEXYL)PHTHALATE	N	N	N	N	N	N	N	N	N	N	N
4-BROMOPHENYL PHENYL ETHER	N	N	N	N	N	N	N	N	N	N	N
BUTYL BENZYLPHTHALATE	N	N	N	N	N	N	N	N	N	N	N
2-CHLORONAPHTHALENE	N	N	N	N	N	N	N	N	N	N	N
4-CHLORO-PHENYL PHENYL ETHER	N	N	N	N	N	N	N	N	N	N	N
CHRYSENE	N	N	N	N	N	N	N	N	N	N	N
DIBENZO(A,H)ANTHRACENE	N	N	N	N	N	N	N	N	N	N	N
1,2-DICHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N
1,3-DICHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N
1,4-DICHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N
3,3'-DICHLOROBENZIDINE	N	N	N	N	N	N	N	N	N	N	N
DIETHYLPHTHALATE	N	N	N	N	N	N	N	N	N	N	N
DIMETHYLPHTHALATE	N	N	N	N	N	N	N	N	N	N	N
DI-N-BUTYLPHTHALATE	N	N	N	N	N	N	N	N	N	N	N
2,4-DINITROTOLUENE	N	N	N	N	N	N	N	N	N	N	N
2,6-DINITROTOLUENE	N	N	N	N	N	N	N	N	N	N	N
DI-N-OCTYLPHTHALATE	N	N	N	N	N	N	N	N	N	N	N
1,2-DIPHENYLHYDRAZINE**	N	N	N	N	N	N	N	N	N	N	N
FLUORANTHENE	N	N	N	N	N	N	N	N	N	N	N
FLUORENE	N	N	N	N	N	N	N	N	N	N	N
HEXACHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N
HEXACHLOROBUTADIENE	N	N	N	N	N	N	N	N	N	N	N
HEXACHLOROCYCLOPENTADIENE	N	N	N	N	N	N	N	N	N	N	N
HEXACHLOROETHANE	N	N	N	N	N	N	N	N	N	N	N
IDENO(1,2,3-CD)PYRENE	N	N	N	N	N	N	N	N	N	N	N
ISOPHORONE	N	N	N	N	N	N	N	N	N	N	N
NAPHTHALENE	N	N	N	N	N	N	N	N	N	N	N
NITROBENZENE	N	N	N	N	N	N	N	N	N	N	N
N-NITROSODIMETHYLAMINE	N	N	N	N	N	N	N	N	N	N	N
N-NITROSODI-N-PROPYLAMINE	N	N	N	N	N	N	N	N	N	N	N
N-NITROSODIPHENYLAMINE***	N	N	N	N	N	N	N	N	N	N	N
PHENANTHRENE	N	N	3	N	N	N	N	N	N	N	N
PYRENE	N	N	3	N	N	N	N	N	N	N	N
1,2,4-TRICHLOROBENZENE	N	N	N	N	N	N	N	N	N	N	N
2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	N	N	N	N	N	N	N	N	N	N	N

* AND/OR BENZO(K)FLUORANTHENE - ISOMERIC PAIRS
** DETECTED AS AZOBENZENE
*** DETECTED AS DIPHENYLAMINE

TABLE 5

ACID EXTRACTABLE ORGANIC PRIORITY POLLUTANTS IN WATER
UNIT=PPB

FACILITY: OIL LANDFARM

	STATION							
ACID EXTRACTABLE ORGANIC	1	5	6	7	8	9	10	16
2-CHLOROPHENOL	N	N	N	N	N	N	N	N
2,4-DICHLOROPHENOL	N	N	N	N	N	N	N	N
2,4-DIMETHYLPHENOL (M-XYLENOL)	N	N	N	N	N	N	N	N
4,6-DINITRO-O-CRESOL	N	N	N	N	N	N	N	N
2,4-DINITROPHENOL	N	N	N	N	N	N	N	N
2-NITROPHENOL	N	N	N	N	N	N	N	N
4-NITROPHENOL	N	N	N	N	N	N	N	N
P-CHLORO-M-CRESOL	N	N	N	N	N	N	N	N
PENTACHLOROPHENOL	N	N	N	N	N	N	N	N
PHENOL	N	N	N	N	N	N	N	N
2,4,6-TRICHLOROPHENOL	N	N	N	N	N	N	N	N

TABLE 6

ACID EXTRACTABLE ORGANIC PRIORITY POLLUTANTS IN SEDIMENT
UNIT=PPM

FACILITY: OIL LANDFARM

	STATION										
ACID EXTRACTABLE ORGANIC	1	2	3	4	5	6	7	8	9	10	13
2-CHLOROPHENOL	N	N	N	N	N	N	N	N	N	N	N
2,4-DICHLOROPHENOL	N	N	N	N	N	N	N	N	N	N	N
2,4-DIMETHYLPHENOL (M-XYLENOL)	N	N	N	N	N	N	N	N	N	N	N
4,6-DINITRO-O-CRESOL	N	N	N	N	N	N	N	N	N	N	N
2,4-DINITROPHENOL	N	N	N	N	N	N	N	N	N	N	N
2-NITROPHENOL	N	N	N	N	N	N	N	N	N	N	N
4-NITROPHENOL	N	N	N	N	N	N	N	N	N	N	N
P-CHLORO-M-CRESOL	N	N	N	N	N	N	N	N	N	N	N
PENTACHLOROPHENOL	N	N	N	N	N	N	N	N	N	N	N
PHENOL	N	N	N	N	N	N	N	N	N	N	N
2,4,6-TRICHLOROPHENOL	N	N	N	N	N	N	N	N	N	N	N

TABLE 7

PCB IN SOLUTION
UNIT=PPB

FACILITY: OIL LANDFARM

PCB	STATION 1	5	6	7	8	9	10	11	12	14	15	16
AROCLOR 1242/1248 AND/OR 1016	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
AROCLOR 1254	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
AROCLOR 1260	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3

SUSPENDED PARTICULATE PCB
UNIT=PPB

FACILITY: OIL LANDFARM

PCB	STATION 1	5	6	7	8	9	10	12	14
AROCLOR 1242/1248 AND/OR 1016	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
AROCLOR 1254	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3
AROCLOR 1260	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3	<.3

PCB IN SEDIMENT
UNIT=PPM

FACILITY. OIL LANDFARM

PCB	STATION 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AROCLOR 1242/1248 AND/OR 1016	< 05	<.05	< 05	< 05	<.05	<.05	<.05	<.05	<.05	<.8*	<.05	<.05	<.05	<.05	<.05
AROCLOR 1254	<.05	< 05	.3	<.05	<.05	<.05	<.05	<.05	<.05	<1*	< 05	<.05	<.05	<.05	<.05
AROCLOR 1260	<.05	<.05	.1	<.05	<.05	<.05	< 05	<.05	<.05	1.1	<.05	<.05	<.05	<.05	<.05

* HIGHER DETECTION LIMITS DUE TO INTERFERENCES

TABLE 8

TOTAL METALS (DETERMINED BY ICAP/AA ANALYSIS), TOTAL MERCURY, CYANIDE & PHENOLS IN WATER
UNIT=PPM

FACILITY: OIL LANDFARM

	STATION										
PARAMETER	1	5	6	7	8	9	10	11	12	14	15
ALUMINUM	.11	.11	.21	.24	.19	<.05	<.05	<.05	.64	.11	.32
ANTIMONY	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
ARSENIC	<.2	<.2	<.2	<.2	<.2	<2	<.2	<.2	<.2	<.2	<.2
BARIUM	.048	.073	.98	.95	.042	.104	.086	.059	.081	.22	.093
BERYLLIUM	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
BORON	<.01	.34	.1	.12	.02	<.01	.03	.04	.04	.08	.1
CADMIUM	<.002	.002	.021	.02	<.002	<.002	<.002	<.002	<.001	<.002	<.002
CALCIUM	7.2	129	325	320	6.2	74	105	120	80	65	42
CHROMIUM	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	.05
COBALT	<.01	<.01	.01	.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
COPPER	<.01	.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
IRON	.29	.2	.027	.098	.68	.3	.067	.24	1.7	.2	.48
LEAD	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
LITHIUM	<.1	.2	<.1	.2	<.1	<.1	.1	<.1	<.1	<.1	<.1
MAGNESIUM	4.2	21	42	41	3.2	8.3	13.7	27	16	18	14
MANGANESE	.046	.088	2.5	2.4	.026	.01	1	.14	.31	.018	.016
MOLYBDENUM	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
NICKEL	<.02	<.02	.09	.09	<.02	<.02	<.02	<.02	<.02	<.02	<.02
SELENIUM	<.2	<.2	<.2	<.2	<.2	<.02	<.2	<.2	<.2	<.2	<.2
SILICON	12.2	.89	1.48	2.7	8.6	2	1.8	1	2.1	.28	2.4
SILVER	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
SODIUM	2.8	12.4	37	36	3.4	2.6	3.3	5.8	4.7	6.2	2.3
STRONTIUM	.031	.59	.88	.87	.03	.157	.193	.086	.07	.082	.044
THALLIUM	<.3	<.3	<.3	.6	<.3	<.3	<.3	<.3	<.3	<.3	<.3
TIN	<.2	<.2	<.2	<.2	<.2	<.2	.2	<.2	<.2	<.2	.2
TITANIUM	<.003	<.003	<.003	<.003	<.003	<.003	<.003	.007	.016	.003	.01
VANADIUM	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
ZINC	<.01	.01	<.01	< 01	<.01	<.01	<.01	.03	.03	.04	.04
URANIUM	<2	4	<2	<2	<2	<2	<2	<.5	<2	<.5	<.5
CYANIDE	<.01	<.01	.01	.01	<.01	<.01	<.01	<.01	<.01	.02	<.01
PHENOLS	<.01	<.01	<.01	<.01	<.01	<.01	.01	<.01	<.01	<.01	<.01
MERCURY	<.0001				<.001	<.001	.001				

TABLE 9

METALS DISSOLVED IN WATER (DETERMINED BY ICAP/AA ANALYSIS)
UNIT=PPM

FACILITY: OIL LANDFARM

METAL	STATION 1	STATION 5	STATION 6	STATION 7	STATION 8	STATION 9	STATION 10	STATION 12	STATION 14
ALUMINUM	<.05	<.05	.14	.16	<.05	<.05	<.05	<.05	<.05
ANTIMONY	<.05	<.05	<.05	<.05	<.05	.05	<.05	<.05	<.05
ARSENIC	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
BARIUM	.024	.061	.96	.89	.021	.075	.067	.044	.17
BERYLLIUM	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
BORON	<.01	.56	.11	.11	<.01	.01	.03	.03	.14
CADMIUM	<.002	.001	.012	.012	<.002	<.002	<.002	<.002	<.002
CALCIUM	7.5	130	308	323	5.7	78	112	79	65
CHROMIUM	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
COBALT	<.01	<.01	.01	<.01	<.01	<.01	<.01	<.01	<.01
COPPER	<.01	.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01
IRON	.014	.005	<.005	<.005	.039	<.005	<.005	.03	<.005
LEAD	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
LITHIUM	.1	.3	.1	<.1	.4	<.1	.1	<.1	<.1
MAGNESIUM	4	22	43	42	2.9	8.1	13.6	15	17
MANGANESE	.003	.003	2.4	2.2	.007	.001	.002	12	<.001
MOLYBDENUM	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02	<.02
NICKEL	<.02	<.02	.08	.07	<.01	<.02	<.02	<.02	<.02
SELENIUM	<.2	<.2	<.2	<.2	<.2	<.02	<.2	<.2	<.2
SILICON	15.1	6.5	3.6	3.6	10.4	2.8	3.4	3	3.1
SILVER	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
SODIUM	4.6	12.4	37	36	3.8	2.6	3.3	4.9	6.2
STRONTIUM	.027	.61	.88	.87	.027	.152	.186	.065	074
THALLIUM	<.3	<.3	<.3	<.3	<.3	.3	<.3	<.3	<.3
TIN	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2	<.2
TITANIUM	.003	.003	<.003	<.003	<.003	.003	.003	<.003	<.003
VANADIUM	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
ZINC	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
URANIUM	<2	4	<2	<2	<2	<2	<2	<.5	<.5

TABLE 1.1

MISCELLANEOUS CONVENTIONAL AND NONCONVENTIONAL POLLUTANTS AND RELATED PARAMETERS
UNIT=PPM UNLESS OTHERWISE STATED

FACILITY: OIL LANDFARM

METER STATION	1	5	6	7	8	9	10	11	12	14	15	16
L SUSPENDED SOLIDS	4	2	2	2	8	14	<1	14	20	4	2	20
L DISSOLVED SOLIDS	90	660	1850	1780	80	290	740	770	400	400	200	110
YL ORANGE ALKALINITY (AS CACO3)	50	152	120	116	44	144	160	145	105	130	120	128
OLTHALINE ALKALINITY (AS CACO3)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
UCTIVITY (IN UMHOS/CM)	100	910	2732	2732	78	510	711	1028	590	570	410	291
ATE	6	300	90	85	6	70	90	338	100	53	34	5
RIDE	1.5	18	39	38	1.2	5	50	21	15	7	4	12
ATE - N	<.01	.17	110	120	<.01	<.01	<.01	.03	.05	49	11	<.01
NIA - N	.1	.09	.2	.2	.1	.1	.2	.1	.1	.1	.1	.7
L KJELDAHL NITROGEN	.17	.63	.14	.1	.2	.3	1.8	.5	.6	.1	.7	.8
G PHOSPHATE - P	.07	<.01	<.01	<.01	.01	<.01	.26	<.01	.03	<.01	<.01	3
RIDE	.2	2	.6	3	.2	.7	.4	<.1	.5	.65	1.2	7
ICAL OXYGEN DEMAND	8	34	4	4	8	35	630	110	90	10	30	28
HEMICAL OXYGEN DEMAND	2	3	2	3	<1	<1	7	7	4	2	2	2
OLVED ORGANIC CARBON	<1	3	<1	<1	<1	7	192	33	32	7	7	6
L ORGANIC CARBON	3	12	5	5	3	9	236	36	29	4	3	7
& GREASE IN WATER		.6	.2	.9	1	1	9	<1	<1	<1	<1	4.4
& GREASE IN SEDIMENT					328	230	32000	136	593	189	233	
IN PH UNITS)	7.4	7.53	7.7	6.8	6.92	6.81	6.1	5.9*	6.64*	7.84*	7.96*	6.2
OLVED OXYGEN	9.3	7.6	9.6	9.6	9.3	5.2	7.7	6.7	6.3	9.2	9.3	
X (IN MV)	75	193	201	230	221	164	171	214*	207*	243*	226*	115
R TEMP. (IN DEGREES CENTIGRADE)	15.4	13.3	12.9	13 5	12.8	9.8	8.3	10.4	12.8	16.4	16.2	21.3

* THIS VALUE REPRESENTS A MEAN VALUE, SAMPLE SIZE = 3